

Lewis and Clark Complex BAER

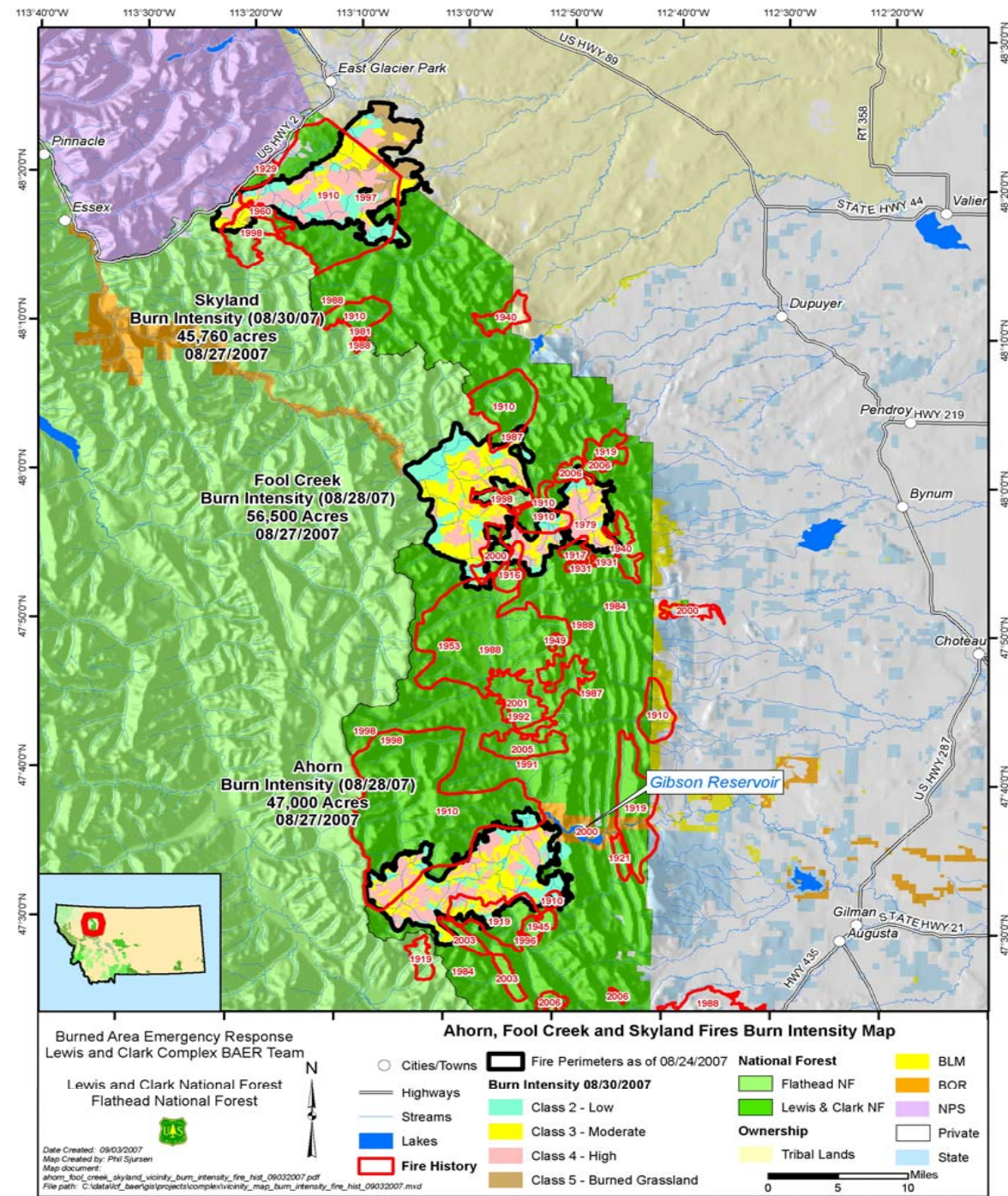
Montana Hydrology Conference
2008



L&C Complex BAER

Three wildfires totaling
>150,000 Acres

Skyland Fire
Fool Creek Fire
Ahorn Fire



BAER

- Burn Area Emergency Response
 - Life and Property
 - Water Quality
 - Fisheries/Aquatics
 - NFS Roads
- BAER Team is a multi-disciplinary group that includes:
 - Hydrologist
 - Soil scientists
 - Fish Biologist
 - Silviculturalist
 - Archeologist
 - Range
 - GIS
 - Engineer

Lewis and Clark Complex

- Was a multi-agency, multi-Forest operation.
- Included
 - Lewis and Clark NF
 - Flathead NF
 - Blackfeet Reservation
 - BIA (Hydro)

L&C Complex BAER

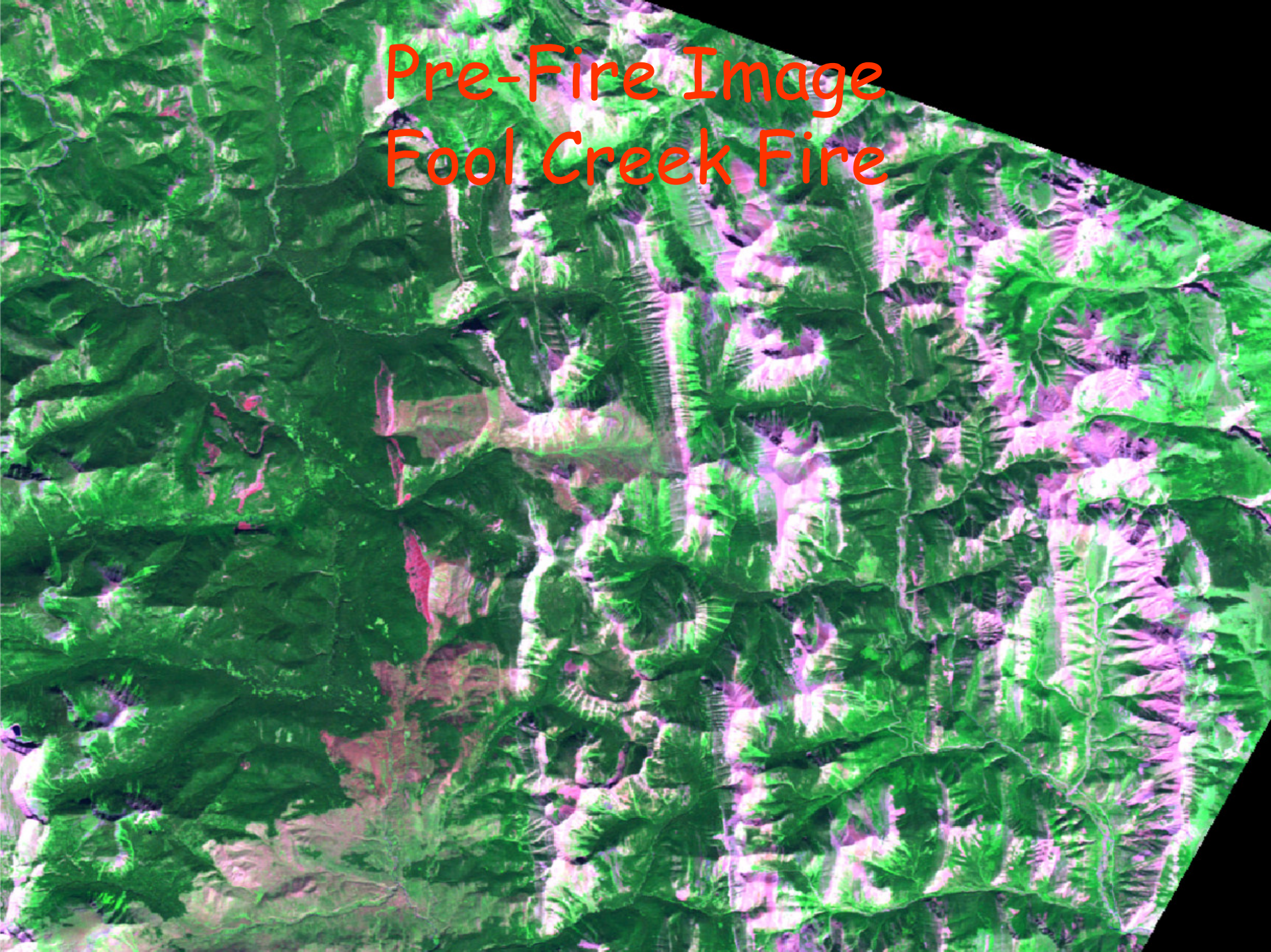
- Lewis and Clark received over \$1 million in requested BAER funds.
 - Trail work (All Fires)
 - Roads (Fool Creek & Skyland)
 - Weed control (All)

Initial Investigation

BARC

- Burn Area Reflectance Classification
- Requested through:
**Remote Sensing Applications Center
(RSAC)**
- Involves three main steps:

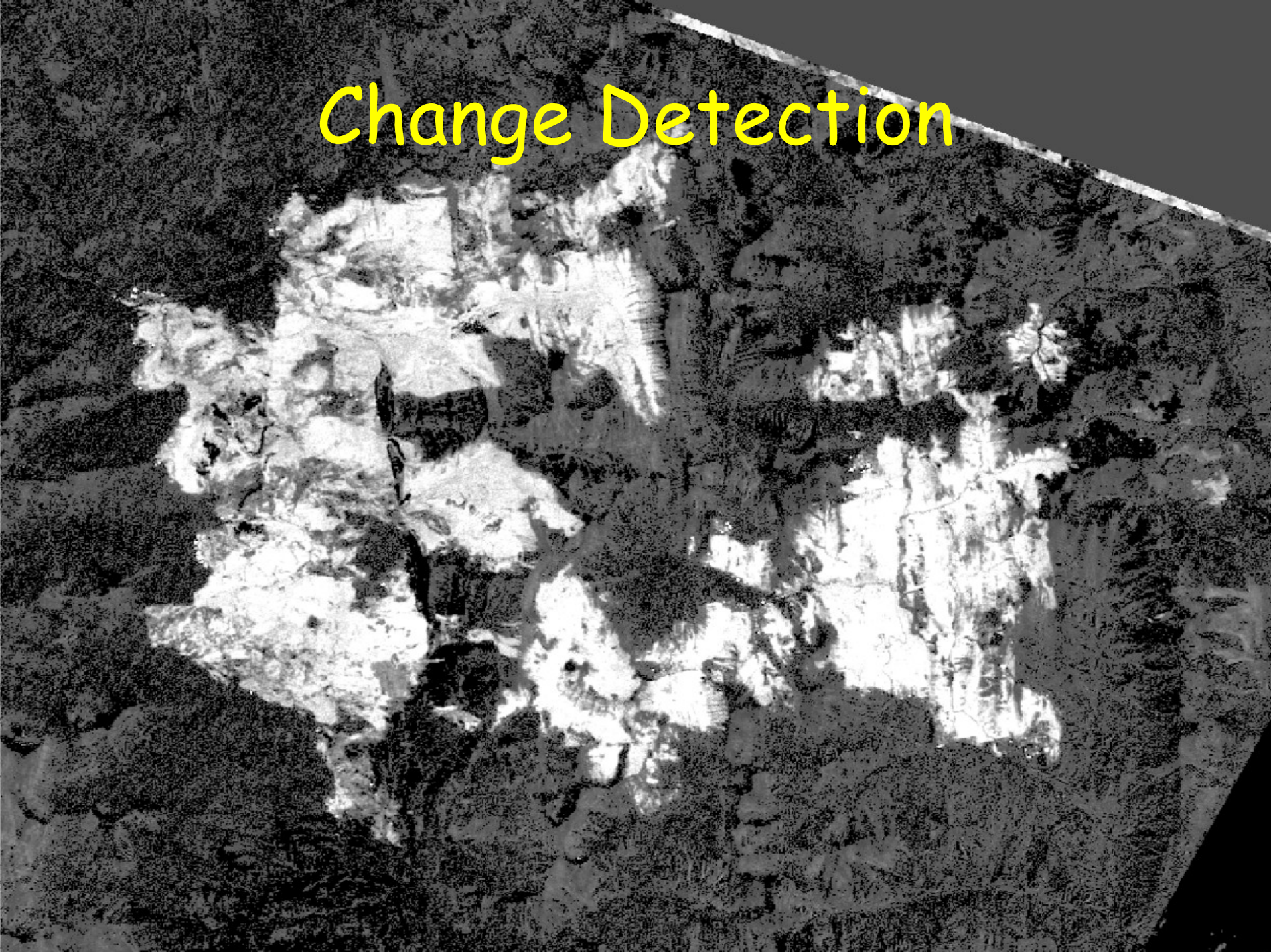
Pre-Fire Image Fool Creek Fire



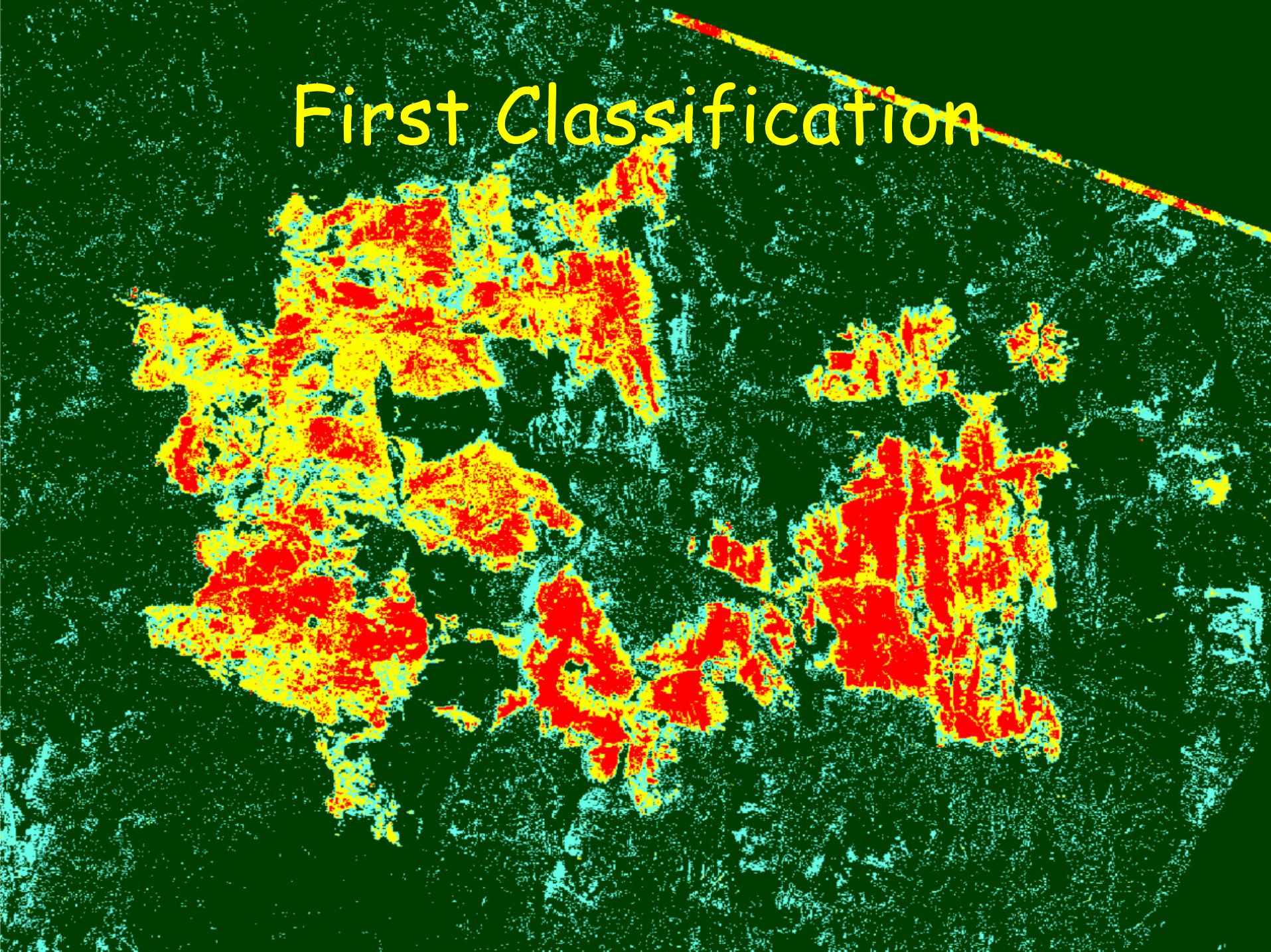


Post Fire Image

Change Detection



First Classification



Classification

- First Classification is basically a color operation.
- Needs to be ground verified. Or fly Verified.
- Classified as High, medium or Low/no burn intensity.
- Normally we would like to see a correlation between burn intensity (veg) and Severity (soil).

Resource Condition Assessment

Low Intensity: A burn where very little of the canopy and ground vegetation is consumed, approximately $< 40\%$.

Moderate Intensity: A burn where a portion of the canopy and ground vegetation is consumed, approximately 40-80%.

High Intensity: A burn where almost all of the canopy and ground vegetation is consumed, approximately $> 80\%$.

Mosaic: A mix of fire intensities that would include both low and unburned areas.



Fool Creek Fire Treatments

Burned Area Emergency Response (BAER)
Lewis and Clark Complex BAER team
(Ahorn, Fool Creek and Skyland Fires)

Lewis and Clark and Flathead
National Forests



56,479 acres as of 08/24/2007

The intent of this map is to display treatments for the
Fool Creek Wildfire, Montana

Intensity analysis as of 08/28/2007. Fire perimeter as of 08/24/2007.

All proposed treatments were designed to protect identified values at risk, increasing the capacity of existing culverts (A1-7) and adding 10 additional culverts (A8) along FS 144 will protect road infrastructure, maintain safe access to important recreation areas, and protect water quality on the North Fork of the Teton River. Hazard tree removal in zone C will protect Massey Tract recreation cabins and the West Fork Cabin. Trail treatments will protect the trail sub-systems by reducing hazard damage. Barriers on hilltops >10% that based on moderate or high intensity. Trails with >10% hilltops require no damage features, but based on moderate or high intensity and high intensity based areas for safe walking access. Wind spraying and mowdown was designed to protect back adjacent to the trail system from additional loss identified weed sources.

Legend

- Teton Pass Ski Area
- Roads - LCNF
- Trails Outside Fire Perimeter - LCNF & FNS
- West Slope Cutthroat Trout Distribution**
- 100% Genetic Purity
- 90-99% Genetic Purity
- Treatment Locations**
- Massey Tract Recreation Cabins
- West Fork Guard Station
- West Fork Campground
- Culvert Treatments (A1-A5)
- Cross Drain Culvert Treatments (A-6) / Road FS 144
- Small HUC's Delineated for Culverts
- Trail Treatments**
- Trails on Slopes Less than 10%
- Trails on 10-20% Terrain Slope (Low)
- Trails on slopes Greater than 20% (High)
- Treatments or Monitoring Zones**
- Treatment and Monitoring of Weeds
- Increase Culvert Capacity
- Allotments
- Invasive Weeds Inventory
- Wilderness
- National Forest Boundary
- US Forest Service Ownership
- Fool Creek Fire Perimeter 08/24/2007
- Burn Intensity 08/25/2007**
- Class 2 - Low
- Class 3 - Moderate
- Class 4 - High

Scale 1:25,000 printed on ANSI E paper size (34" x 44")

0 0.5 1 2 Miles

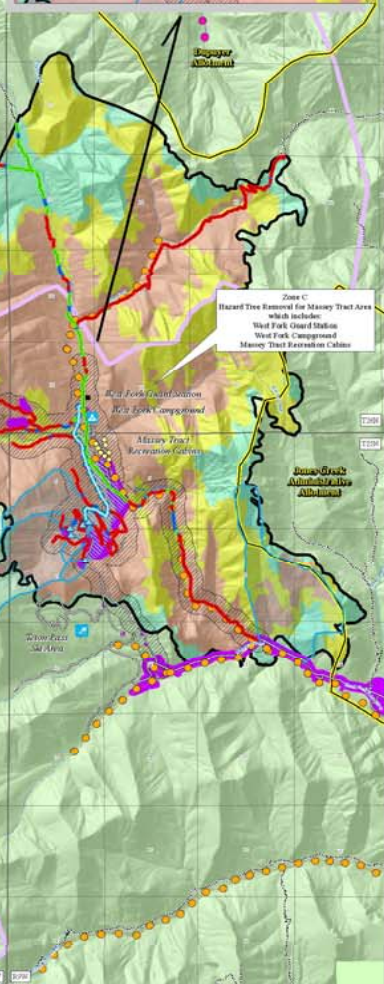
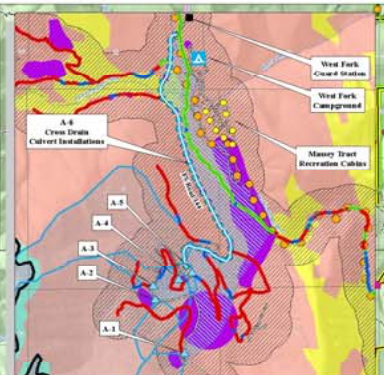
Source: American Geographic 6.2007
Checked by: Phil Gorman, USFS
Map document: Fool Creek Fire Treatments/BAER/BAER_08/28/07
Disclaimer: The Forest Service products were developed for a non-commercial assessment at a scale of 1:24,000. As such, use of these products for more detailed purposes may not be appropriate. Original data was compiled from various sources and for most current data available. Spatial information may not meet National Map Accuracy Standards. This information may be updated, or corrected, or otherwise modified without notification.
For more information, contact the Lewis and Clark National Forest
BAER Coordinator (406) 731-1740
1001 W. Third Street, Great Falls, Montana, 59405



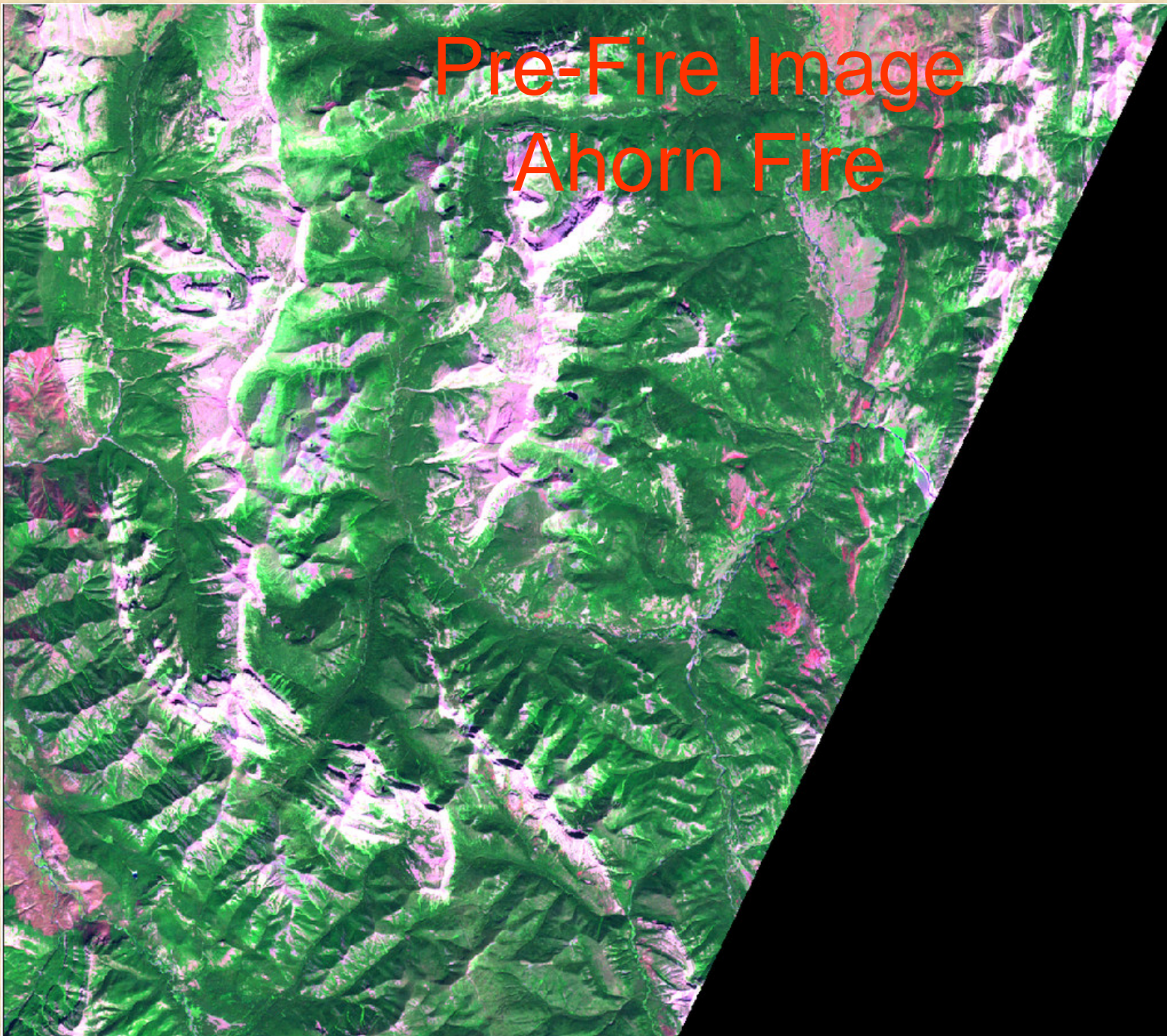
Notes for Trails:

Trails proposed for treatment are those trail segments that exist on the yellow (moderate burn intensity) or pink (high burn intensity) portions.

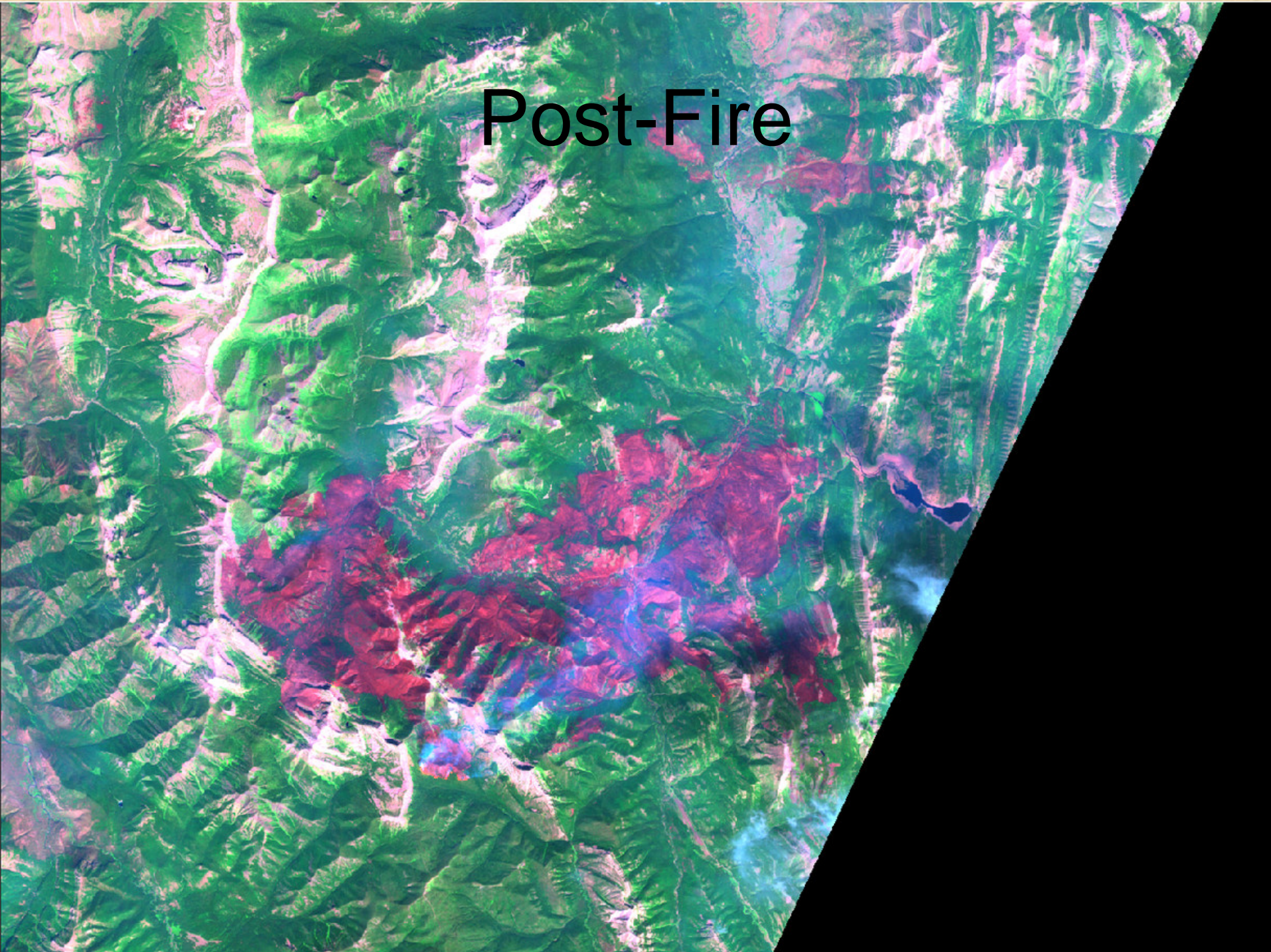
The trail is labeled with trail name - trail number - gradient slope (percentage). Ahorn Cx = 20% / 1:1. Trail gradients are labeled with L for low, or H for high. A slope is also available with gradient, terrain slope and intensity incorporated in the attribute table.



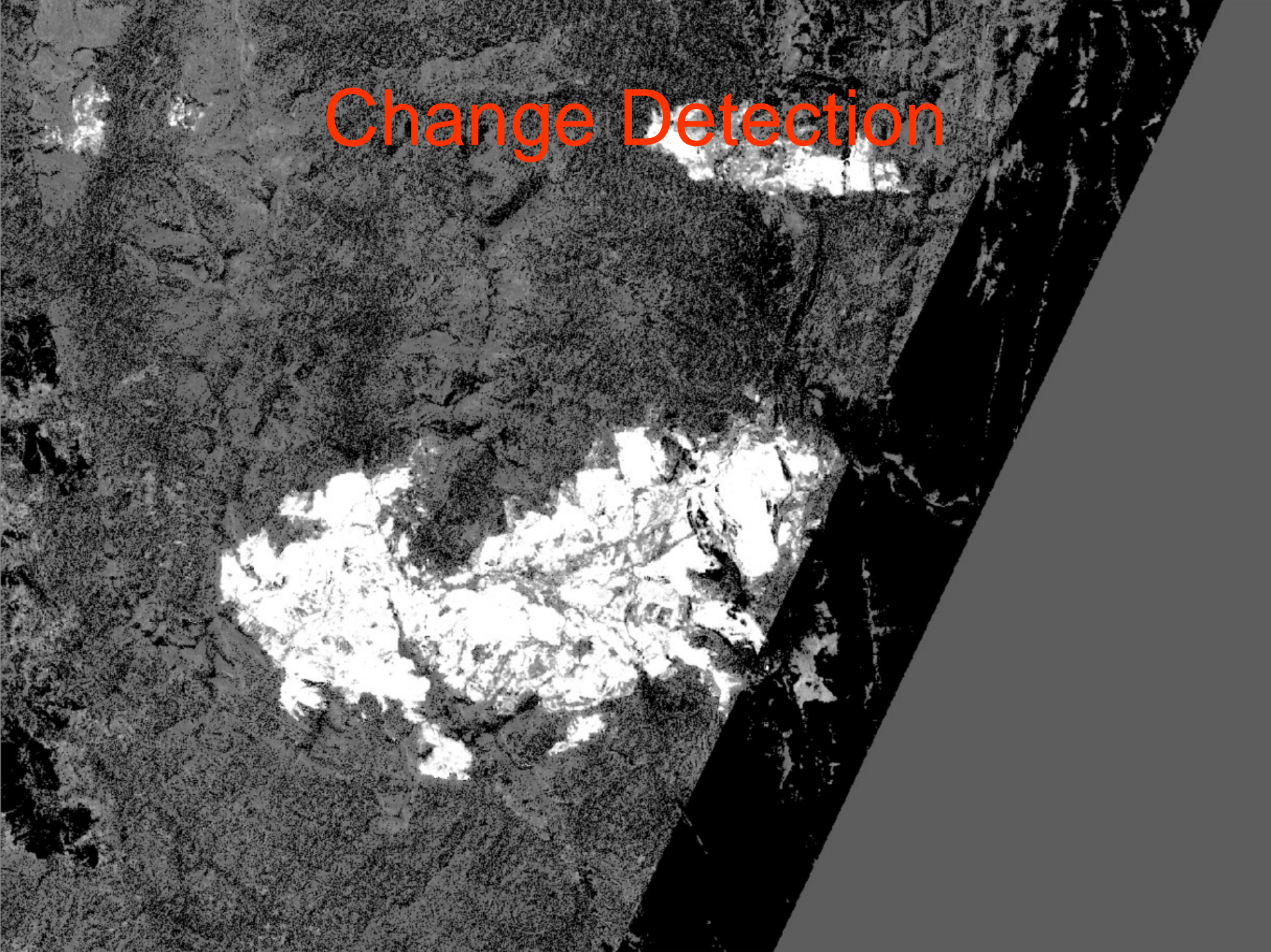
Pre-Fire Image Ahorn Fire



Post-Fire



Change Detection



An aerial photograph of a forest fire, with a color-coded intensity overlay. The background is a dark, grainy aerial image of a forest. Overlaid on this are several irregular, bright patches of color representing fire intensity. The colors range from yellow (low intensity) to red (medium intensity) to bright white (high intensity). The largest and most intense fire area is located in the lower-left quadrant, showing a complex, irregular shape with many small, bright white spots. A smaller, elongated fire area is in the upper-right quadrant, and two smaller, more isolated patches are in the upper-left quadrant. The text 'Biggs Creek Fire 2005' is printed in white in the upper-right area, partially overlapping the fire intensity overlay.

Biggs Creek Fire
2005

Ahorn Fire Treatments

Burned Area Emergency Response

Burned Area Emergency Response (BAER)
Lewis and Clark Complex BAER team
(Ahorn, Foot Creek and Skyland Fires)

Lewis and Clark National Forest



48,412 acres as of 08/26/2007

The intent of this map is to display treatments for the
Ahorn Wildfire, Montana

Analysis as of 08/28/2007. Fire perimeter as of 08/26/2007.

All proposed treatments were designed to protect identified values at risk. Trail treatments will protect the trail infrastructure by replacing burned through barriers on hill-slopes >10% that burned to moderate or high intensity. Trails with >10% hill-slopes require no damage features, but hazard tree removal is required in moderate and high intensity burned areas for safe worker access. Weed spraying and monitoring was designed to protect lands adjacent to the trail system from infestation from identified weed sources.



Scale: 1:57,000 printed on ANSI F paper size (34" x 44")

0 0.5 1 2 Miles

Map Document: AhornFireTreatments.DWG, 10/10/07

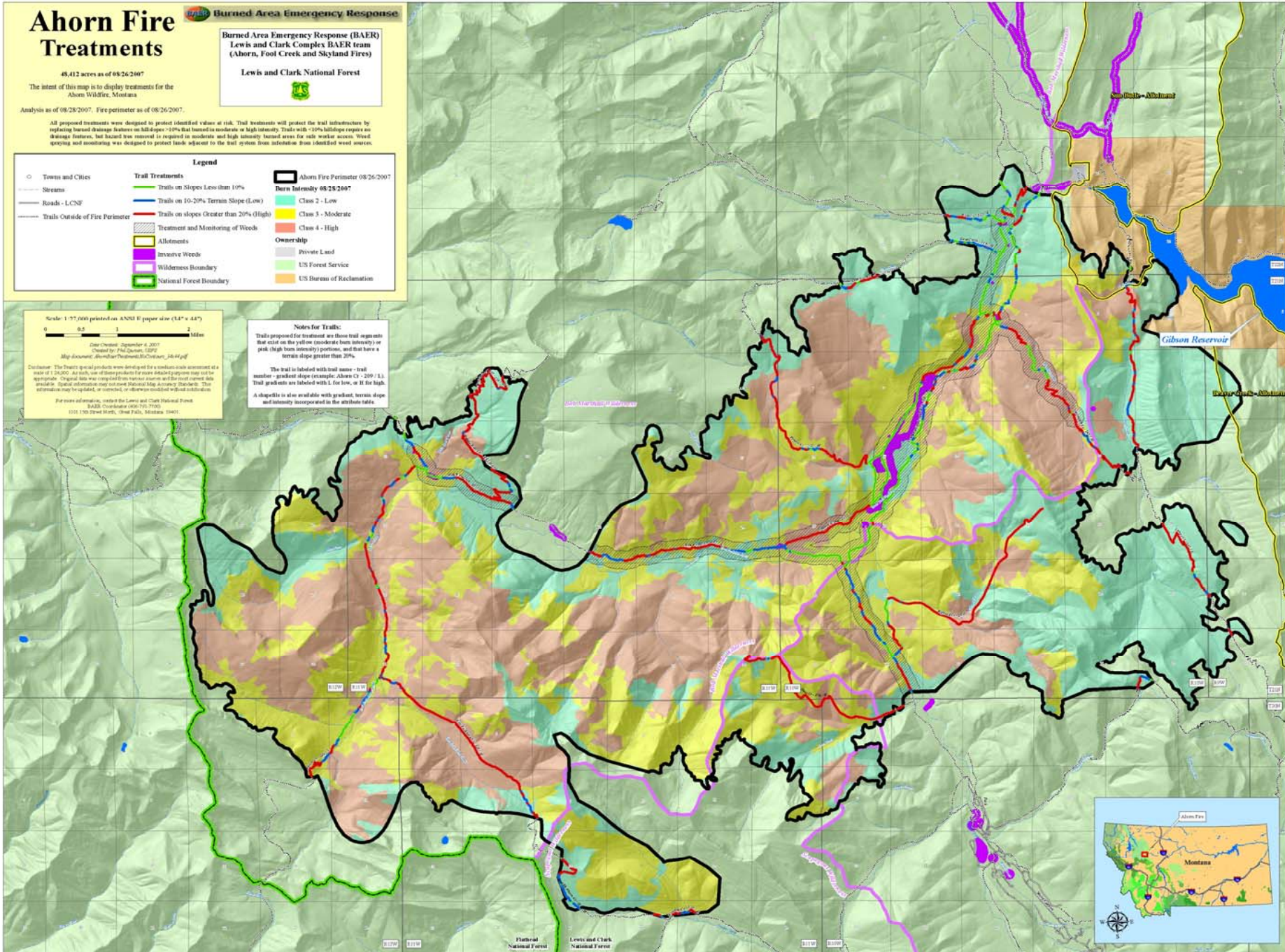
Disclaimer: The map and products were designed for a specific use and are not intended to be used for any other purpose. The map and products are not intended to be used for any other purpose. The map and products are not intended to be used for any other purpose.

For more information, contact the Lewis and Clark National Forest, 3425 Chinle Drive, Boise, Idaho 83725-7000. (208) 335-2000. Lewis and Clark National Forest, 3425 Chinle Drive, Boise, Idaho 83725-7000. (208) 335-2000.

Notes for Trails:

Trails proposed for treatment are those trail segments that exist on the yellow (moderate burn intensity) or pink (high burn intensity) portions, and that have a terrain slope greater than 20%.

The trail is labeled with trail name - trail number - gradient slope (example: Ahorn 12 - 200 1:1). Trail gradients are labeled with L for low, or H for high. A shapefile is also available with gradient, terrain slope and intensity incorporated in the attribute table.



Resource Setting

Watershed Burn Intensity

Fire	Total Acres	Moderate Burn Intensity Acres	High Burn Intensity acres
Skyland Fire	45,760	10,809	14,897
Fool Creek Fire	56,500	14,372	3,260
Ahorn Fire	47,000	16,678	6,071

Storm flow models

- Fire Hydrology NRCS, 2002 for watersheds <5000 acres
- Adjustments to USGS (2004) for watersheds > 5000 acres
 - Parrett, Charles and D.R. Johnson. 2004. Methods for Estimating Flood Frequency in Montana Based on Data through Water Year 1998. USDI/USGS, Water-Resources Investigations Report 03-4308.
 - Available on the net: <http://mt.water.usgs.gov/freq>
- Culvert Capacity was determined with a culvert capacity template developed by the MSU Civil Engineering Department.

Fire Hydrology NRCS

- Excel Spreadsheet
- Runoff curve numbers for model were derived from the tables within the NRCS spreadsheet.
- Fire Hydrology Version 1.3 (developed by Geoff Cerrelli, Civil Engineer with the NRCS) Watersheds <5,000 Acres
- The model was run for unburned and burned for 2yr-6hr, 5yr-6hr, 10yr-6-hr, 25yr-6hr, 50yr-6hr, and 100yr-6-hr design storms.
- Culvert capacity template developed by the MSU Civil Engineering Department

- **Land Cover Description and Condition**
 - High Intensity Burn Hydrologic Soil Group (HSG) B/C 85
 - Moderate Intensity Burn B/C 70
 - Low Intensity & Unburned B/C 65

Runoff Curve Number Method

- To estimate storm flow runoff the unit hydrograph was used to develop stream hydrographs.
- The runoff methodology is described in detail in the SCS (1973) Engineering Field Manual.
- This method is widely used in the western and mid-western US for watersheds less than 10 mi² to estimate peak rates of discharge
- Runoff volumes for a range of rainfall amounts, soil types, land use, cover condition, and average watershed types.
- Very useful to estimate storm flow for areas that have undergone cover condition changes such as forest fires or land clearing.
- But.....

The Precipitation Frequency Atlas of the Western United States—Montana (NOAA, 1973)

- For the fire areas indicates the following precipitation intensity for 6hr and 24 hr storms.
- 2 Yr, 24 hr Prec. (in) = 2.2
- 2 Yr 6 HR Prec.(in)=1.2
- 5 Yr, 24 hr Prec. (in) = 2.6
- 5 Yr, 6 hr Prec. (in) = 1.7
- 10 Yr, 24 hr Prec. (in) = 3.0
- 10 Yr, 6 HR Prec.(in)= 1.2

Precipitation Frequency (cont)

- 25 Yr, 24 hr Prec. (in) =3.4
- 25 Yr, 6 HR Prec.(in)=2.1
- 50 Yr, 24 hr Prec. (in) =4.0
- 50 Yr, 6 hr Prec. (in) =2.3
- 100 Yr, 24 hr Prec. (in) = 4.4
- 100 Yr, 6 HR Prec.(in)= 2.5

Regression for Northwest Region Basin Characteristics

Site	Area (mi ²)	p		Q2	Q5	Q10	Q25	Q50	Q100	Q500
West Fork Sun	342.91	39		3606	5531	6423	8696	11551	15646	32029
North Fork Sun	265.69	42		3102	4733	5470	7396	9853	13389	27563

p=Mean Precipitation







USGS Gaging Stations

- 50 mile radius
- NF Sun above Gibson
- Sun River near Vaughn
- Beaver Creek Near Gibson Dam
- And many more

Debris Flows

- Hyper-concentrated >50% by volume
- Resists deformation
- Bingham Fluid-freshly mixed concrete



7.18.2002



7.18.2002



7.18.2002

Gibson Reservoir Estimated Increases

- Total water yield for Gibson Reservoir and potential change from the Fool Creek and Ahorn fires was estimated with ECA calculations.
- ECA coefficients used included
 - baseline 1.5 acre-feet/acre water yield
 - F values (water yield increase factor)
 - 0.32 for high intensity burn
 - 0.2 for moderate intensity burn.

Table 3b. Peak flows >5000 Acres

Watershed	HUC #	Acres	Area mi ²	Pre Q2	Pre Q 10	Pre Q25	Post Q2	Post Q10	Post Q25
Skyland Fire									
Two Medicine	1003020101	190008	297	3221	5778	7852	3599	6458	8776
Md Fk Flathead	1701020703	197959	309.31	3343	5971	8099	3391	6057	8216
Fool Creek Fire									
MF Flathead	1070120701	130748	204.29	2284	4272	5909	2586	4836	6688
NF Teton	1070120501	96834	151.3	1734	3353	4703	1944	3759	5273
NF Sun	1070120401	169888	265.45	2905	5277	7210	3045	5532	7558
Ahorn Fire									
Upper SF Sun	1003010403	160916	251.43	2764	5051	6919	3315	6059	8298
W. Lwr SF Sun	1003010404	118681	185.44	2090	3951	5490	2102	3973	5520

Results

			Baseline Water yield	High burn	High burn	Mod burn	Mod burn	Total water yield	% Increase
HUC	HUC #	HUC acres	ac-ft	acres	ac-ft	acres	ac-ft	ac-ft	yield
NF Sun River	1003010401	169888	254832	3828	1225	4374	875	256932	100.82%
SF Sun River	1003010403	160916	241374	16677	5337	16072	3214	249925	103.54%
Total Gibson Reservoir Inflow		330804	496206	20505	6562	4374	4089	506857	102.15%

Sediment % increase (average annual precipitation)

- Sun River above Gibson Reservoir
- Potential sediment yields were estimated using the R1R4 sediment model (Cline, 1981)
- based on an average landtype (Lewis and Clark does not have an updated Land Type Inventory)
- base erosion rate of 25 tons/mi²/year
- 45% slope
- land use slope factor of 1.07
- sediment delivery ratio of 0.26

Results

- Year 1 33.6%
- Year 2 6.8%
- Year 3 1.9%

- Sediment in the actual drainages affected by the fire would likely be 100 to 200% above natural but for the Sun River system would be about a 33.6% increase the first year after the fire and decrease to 1.9% by year 3.
- By year 5 after the fire increased sediment effects would likely be reduced to near pre-fire levels due to soil protection recovery from re-vegetation and mulch recovery.

Pike Creek Road Station









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